Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

Absolute Position Encoder

Netzer
Precision Motion Sensors Ltd.

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Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

1.1 TABLE OF CONTENTS

1. Preface 3
1.1 Version : 1.2 July 2015 3
1.2 Applicable documents 3
2. Safety 3
2.1 Safety issues 3
2.2 ESD notes 3
3. Product Overview 4
3.1 Overview 4
3.2 Installation flow chart 4
3.3 Encoder Mounting 5
4. Unpacking 7
4.1 Standard Order 7
5. Electrical interconnection 8
6. Software Installation 9
6.1 Minimum Requirements 9
6.2 Installing the Software 9
7. Mounting Verification 10
7.1 Starting the Encoder Explorer 10
7.2 Mechanical Installation Verification 10
8. Calibration 12
8.1 Offset Calibration 12
8.2 CAA Calibration 14
8.3 Setting the Encoder Zero Point 15
8.4 Jitter test 15

Netzer
Precision Motion Sensors Ltd.

Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

1. PREFACE

1.1 VERSION : 1.2 JULY 2015

1.2 APPLICABLE DOCUMENTS

- DS-90 Electric Encoder data sheet

2. SAFETY

2.1 SAFETY ISSUES

2.2 ESD NOTES

Although the DS-90 Electric Encoder is insensitive to ESD and parasitic capacitive coupling from adjacent AC voltages, we highly recommend to enable a discharge path with <20 kΩ between the machine shaft and the electronics ground. Shielding: the Electric Encoder housing material is non-conductive polymer – ULTEM, the internal ground (return) path of the 5V power supply IS NOT CONNECTED to the cable shielding. We highly recommend grounding the cable shielding through the connector body or by other means.

Note: During high-speed rotation, bearings may isolate the shaft from its grounding. It is essential the shaft remain grounded using a sustainable method during such high-speed operations.

Netzer
Precision Motion Sensors Ltd.

Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

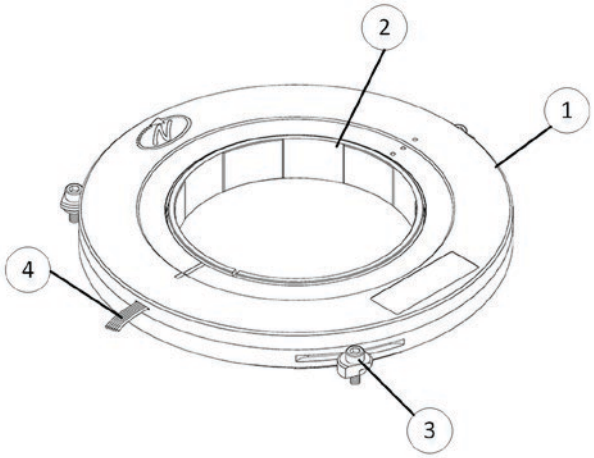
3. PRODUCT OVERVIEW

3.1 OVERVIEW

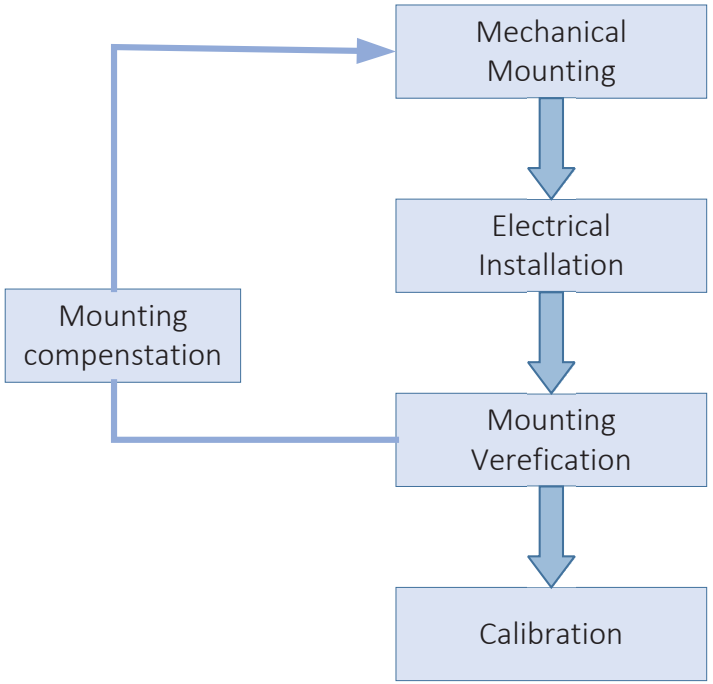
The DS-90 absolute position Electric Encoder™ is a revolutionary position sensor originally developed for harsh environment critical applications. Currently it performs in a broad range of applications, including defense, homeland security, aerospace, and medical and industrial automation.

The Electric Encoder™ non-contact technology relies on an interaction between the measured displacement and a space/ time modulated electric field.
The DS-90 Electric Encoder™ is semi-modular, i.e., its rotor and stator are separate, with the stator securely housing the rotor.

(1) Encoder stator
(2) Encoder rotor
(3) Encoder mounting clamps



3.2 INSTALLATION FLOW CHART

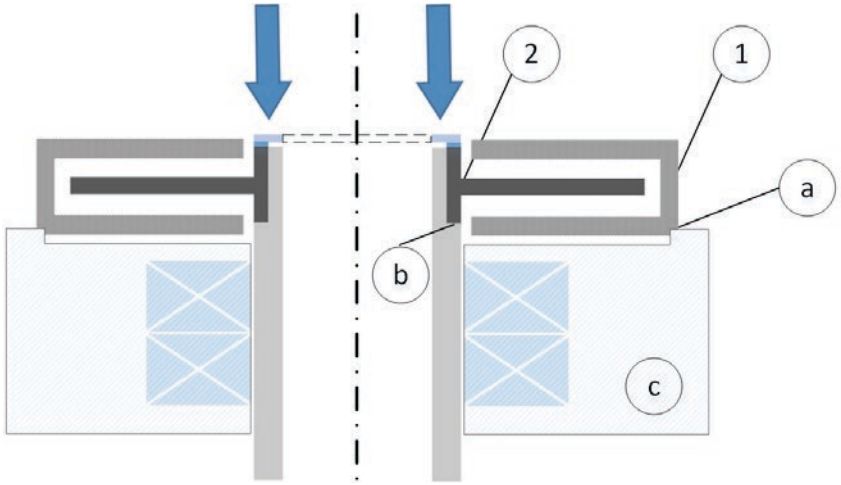


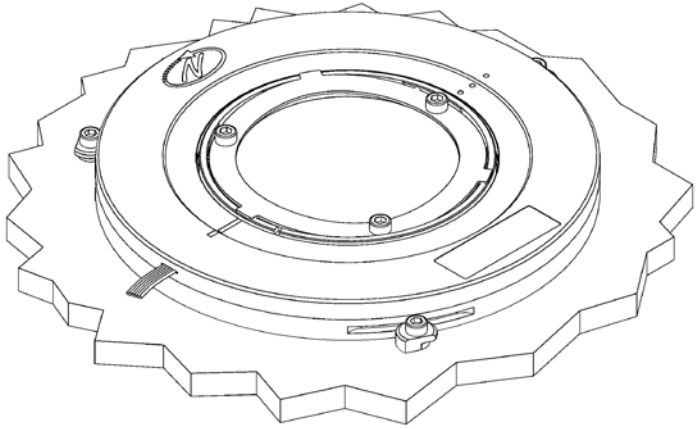
Netzer
Precision Motion Sensors Ltd.

Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

3.3 ENCODER MOUNTING





Encoder mounting

The encoder rotor (**2**) attaches to the host shaft by pressing it against a dedicated shoulder (**b**). A screw and washer or circular spring and washer at the end of the shoulder maintain pressure. The encoder stator (**1**) is centered by circumferential step (**a**) and attached to the host stator (**c**) using three factory supplied clamps.

Netzer
Precision Motion Sensors Ltd.

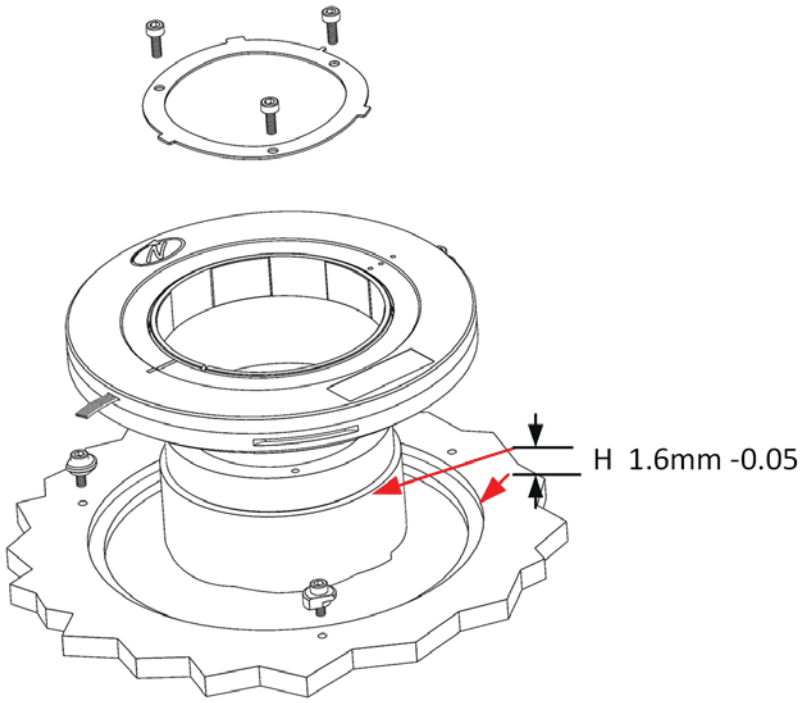
Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

ENCODER STATOR / ROTOR RELATIVE POSITION

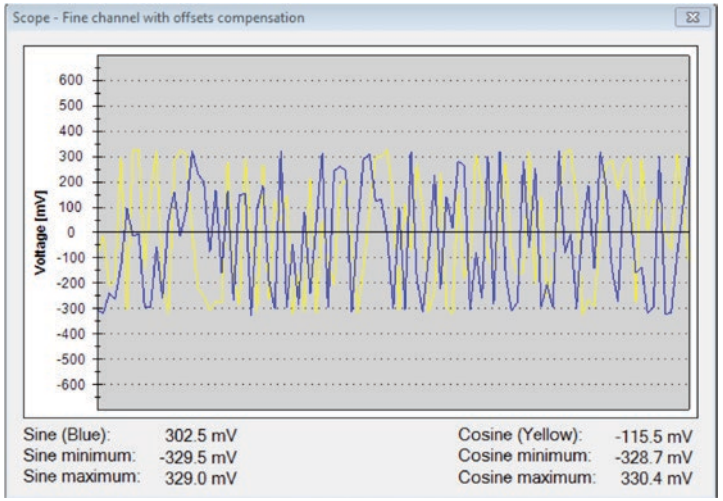
The rotor is floating, therefore, for proper relative axial mounting distance "**H**" between the shaft shoulder (**b**) and stator mounting recess (**a**) should be 1.5 mm nominal.
For ease of mechanical mounting compensation by rotor shims, the recommended distance is **1.6 - 0.05 mm**, yielding analog output amplitudes as follows:

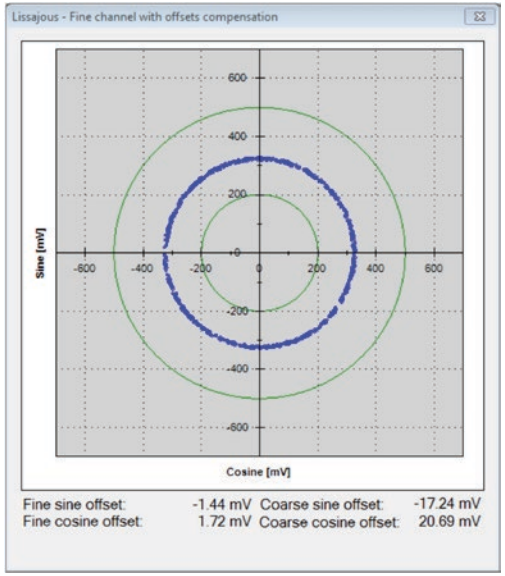
Fine channel	300- 500 mV
Coarse channel	200- 400 mV



Compensate host machine axial dimension inaccuracy by using 50 um shims below the rotor (available as DS90-R-00 kit).

Verify proper rotor mounting with the Encoder Explorer tools "Signal analyzer" or "Mechanical installation verification."




Lissajous - Fine channel with offsets compensation
Sine [mV]
Cosine [mV]
Fine sine offset: -1.44 mV
Fine cosine offset: 1.72 mV
Coarse sine offset: -17.24 mV
Coarse cosine offset: 20.69 mV

Netzer
Precision Motion Sensors Ltd.

Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

4. UNPACKING

4.1 STANDARD ORDER

The package of the standard DS-90 contains the encoder and three standard s/s mounting clamps **OPTIONAL ACCESSORIES**

(1) **DS90-R-00** ,Rotor mounting shims : x10 stainless steel 50um thick rotor mounting shims
(2) **MA-DS90-004** , end of stepped shaft installation kit (screw , washer)
(3) **MA-DS90-001** , end of smooth shaft installation kit (screw , washer , C-ring)
(4) **CNV-0003** , RS-422 to USB converter (with USB internal 5V power supply path)

Netzer
Precision Motion Sensors Ltd.

Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

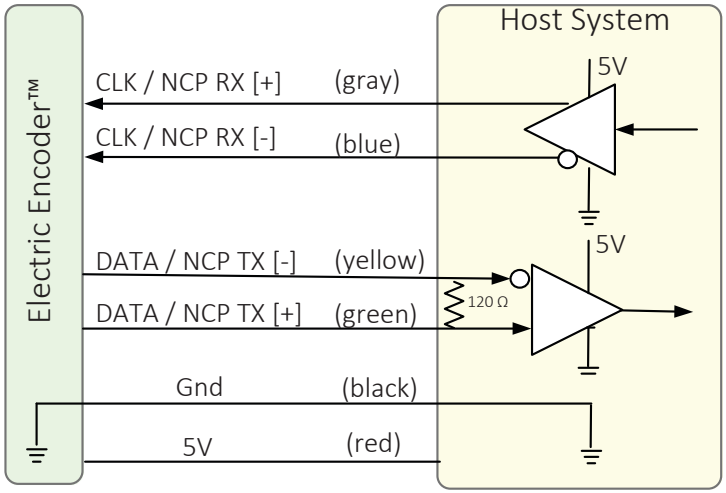
5. ELECTRICAL INTERCONNECTION

This chapter reviews the steps required to electrically connect the DS-90 with digital interface (SSi or BiSS-C).

CONNECTING THE ENCODER

The DS-90 operates has two operational modes:

(i) i. Absolute Position over SSi or BiSS-C: This is the power-up default mode.

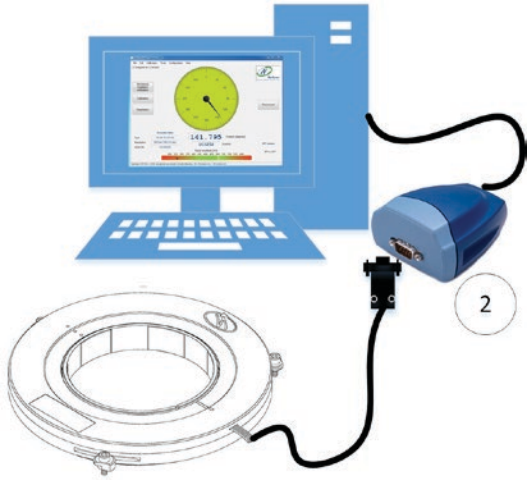


SSi / BiSS interface wires color code		
Clock +	Grey	Clock
Clock-	Blue	
Data-	Yellow	Data
Data +	Green	
GND	Black	Ground
+5V	Red	Power supply

(ii) Configuration and setup mode:

This service mode provides access via USB to a PC running Netzer Encoder Explorer application (on MS Windows 7/8). Communication is via Netzer Communication Protocol (NCP) over RS-422 using the same set of wires.

Use the following pin assignment to connect the encoder to a 9-pin D-type connector to the RS-422/USB converter CNV-0003.



(1) DS-90 encoder with SSi / BiSS interface.
(2) RS-422 / USB converter (CAT No. CNV-00003)

Electric Encoder interface , D Type 9 pin Female			
Description	**Color**	**Function**	**Pin No**
SSi Clock / NCP RX	Gray	Clock / RX +	2
	Blue	Clock / RX -	1
SSi Data / NCP TX	Yellow	Data / TX -	4
	Green	Data / TX +	3
Ground	Black	GND	5
Power supply	Red	+5V	8

Netzer Precision Motion Sensors Ltd.

Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

5.3 ELECTRICAL CONNECTION AND GROUNDING

The DS-90 does NOT come with specified cable and connector, however, do observe grounding consideration:
[1] The cable shield does not connect to the power supply return line.
[2] Ground the host shaft to avoid interference from the host system, which could result in encoder internal noise.

Note : 4.75 to 5.25 VDC power supply required

6. SOFTWARE INSTALLATION

The Electric Encoder Explorer (EEE) software:

- *Verifies Mechanical Mounting Correctness*
- *Offsets Calibration*
- *Sets up general and signal analysis*

This chapter reviews the steps associated with installing the EEE software application.

6.1 MINIMUM REQUIREMENTS

- Operating system: MS windows 7 , 32 / 64 bit
- Memory: 4MB minimum
- Communication ports: USB 2
- Windows .NET Framework , V4 minimum

6.2 INSTALLING THE SOFTWARE

Run the Electric Encoder™ Explorer file found on our website: *Encoder Explorer* Sw Tools.

Netzer
Precision Motion Sensors Ltd.

Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

7. MOUNTING VERIFICATION

Perform mounting verification before calibration to ensure optimal performance by selecting [Verification] on the main screen of the Encoder Explorer or by using the signal analyzer under "Tools."

7.1 STARTING THE ENCODER EXPLORER

Make sure to complete the following tasks successfully:

- Mechanical Mounting
- Electrical Connection
- Connecting Encoder for Calibration
- Encoder Explore Software Installation

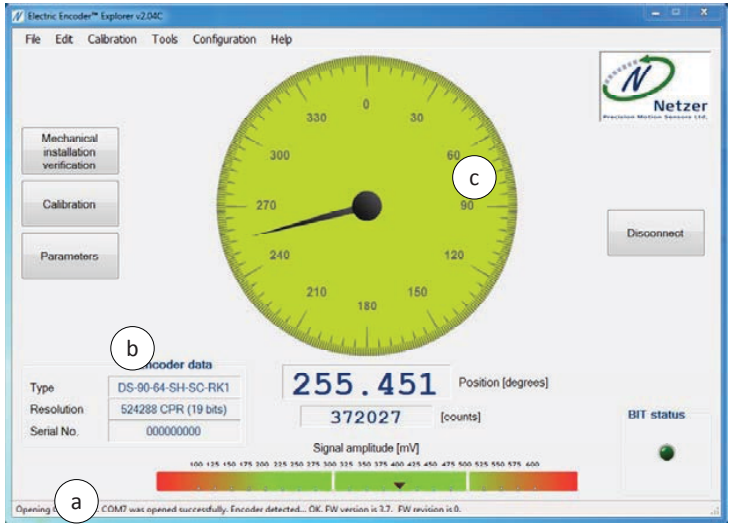
Run the Electric Encoder Explorer tool (EEE).

Ensure proper communication with the encoder:

(**a**) The status bar indicates successful communication.

(**b**) Encoder data displays in the Encoder data area. (CAT No., serial No.)

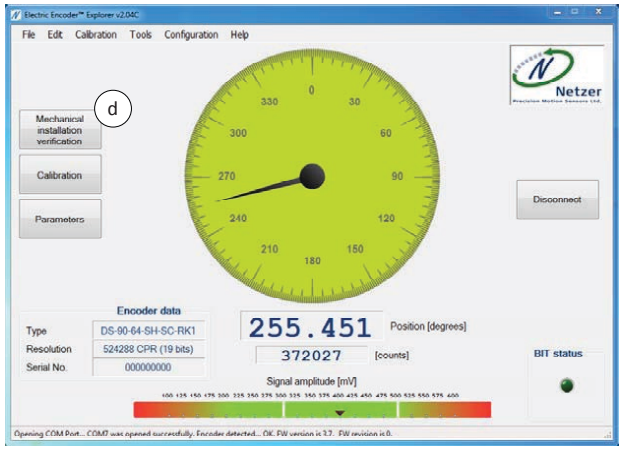
(**c**) The position dial display responds to shaft rotation.



7.2 MECHANICAL INSTALLATION VERIFICATION

The Mechanical Installation Verification provides procedures to ensure proper mechanical mounting by collecting raw data of the coarse and fine channels during rotation.

(**d**) Select [Mechanical Mounting Verification] on the main screen.



Netzer
Precision Motion Sensors Ltd.

Contents

Preface

Safety

Product Overview

Unpacking

Electrical Connection

Software Installation

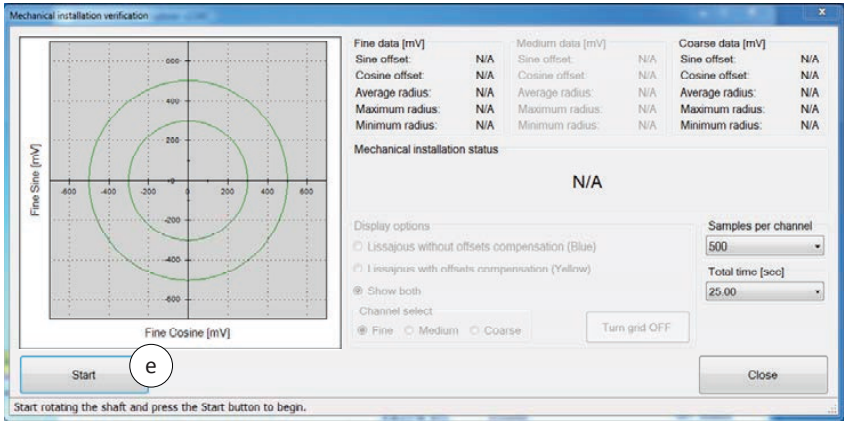
Mounting Verification

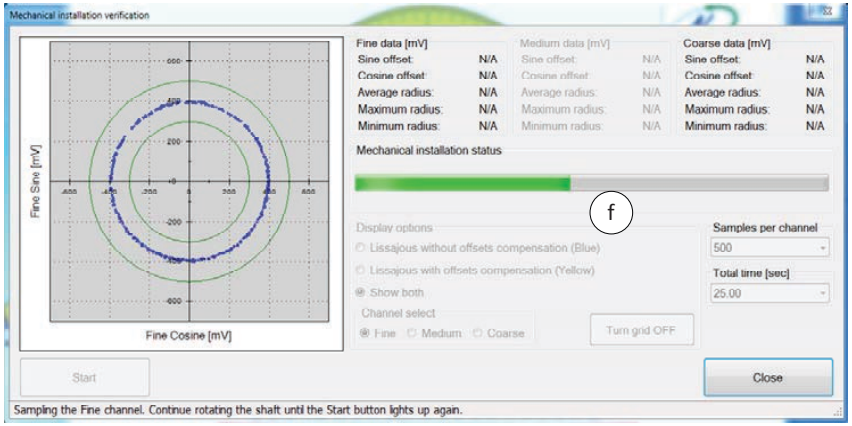
Calibration

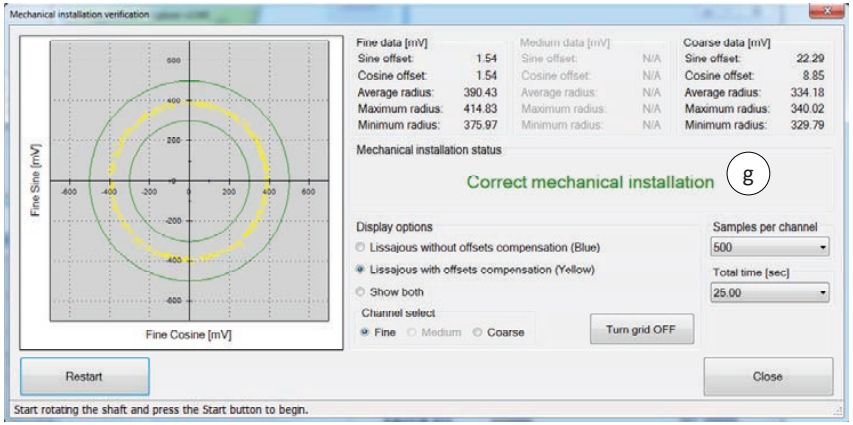
Mechanical ICD

Mounting options

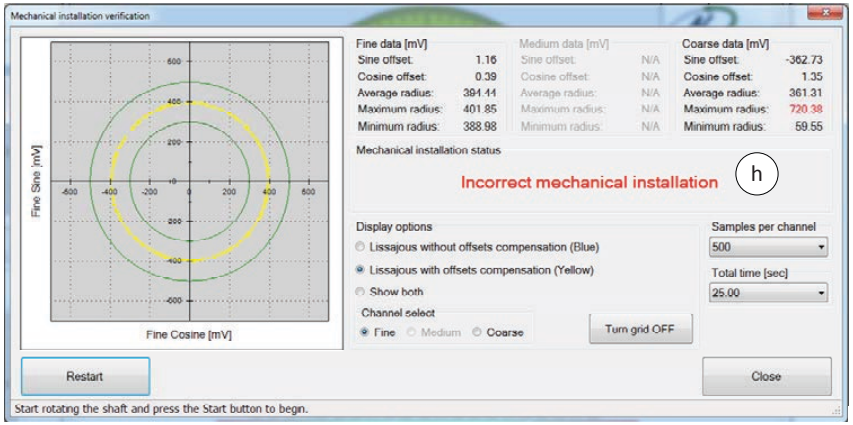
(**e**) Select [Start] to initiate the data collection.
(**f**) Rotate the shaft for data collecting of the fine/coarse channels.
(**g**) At the end of successful verification, SW shows "Correct Mechanical Installation."







(**h**) If SW indicates "Incorrect Mechanical Installation," place the mechanical shims below the rotor, as presented in paragraph 3.3 - "Rotor Relative Position."



Netzer
Precision Motion Sensors Ltd.

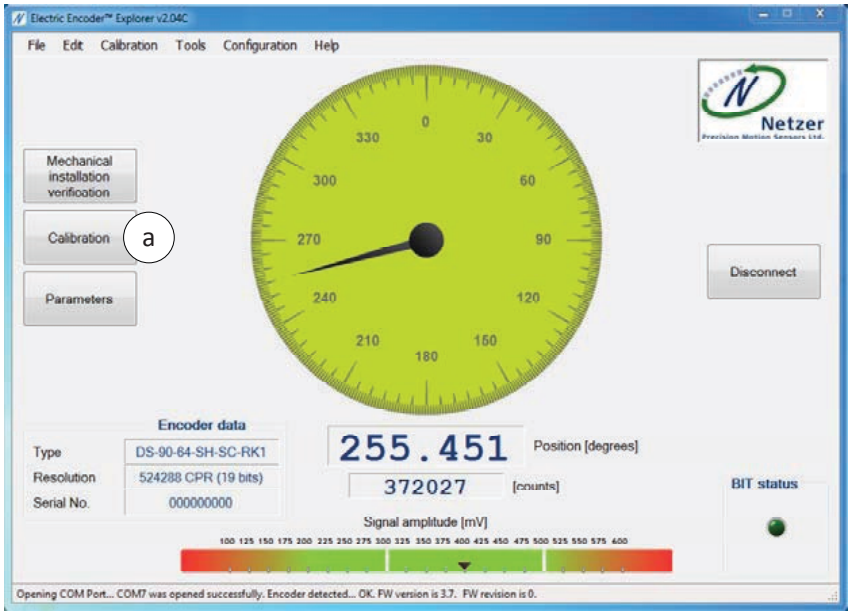
Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

8. CALIBRATION

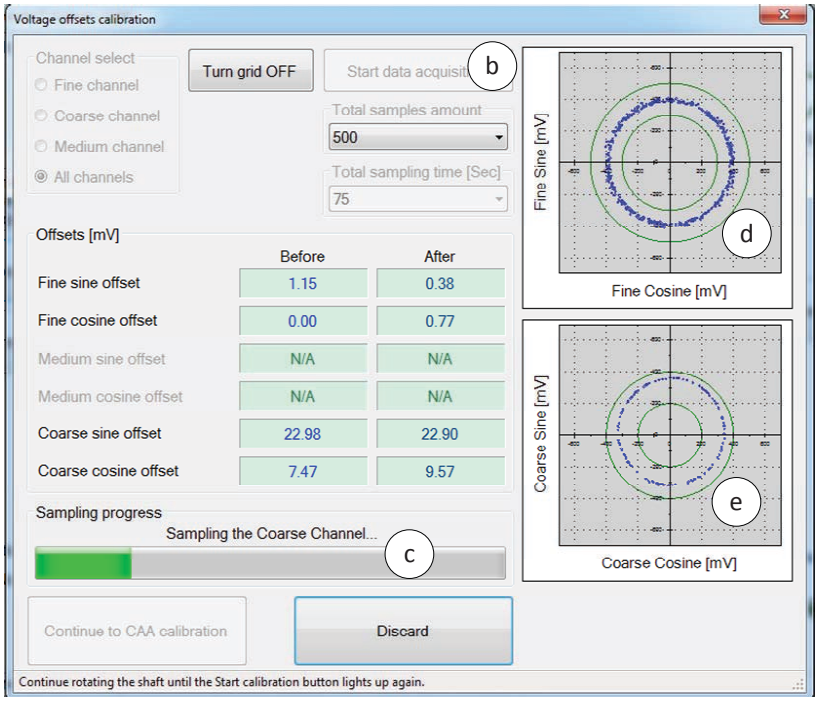
8.1 OFFSET CALIBRATION

For optimal performance of the DS-90 Electric Encoder, the inevitable DC offset of the sine and cosine signals must be compensated over the operational sector.
After successfully completing the Mounting Verification procedure:
(**a)** Select [Calibration] on the main screen.

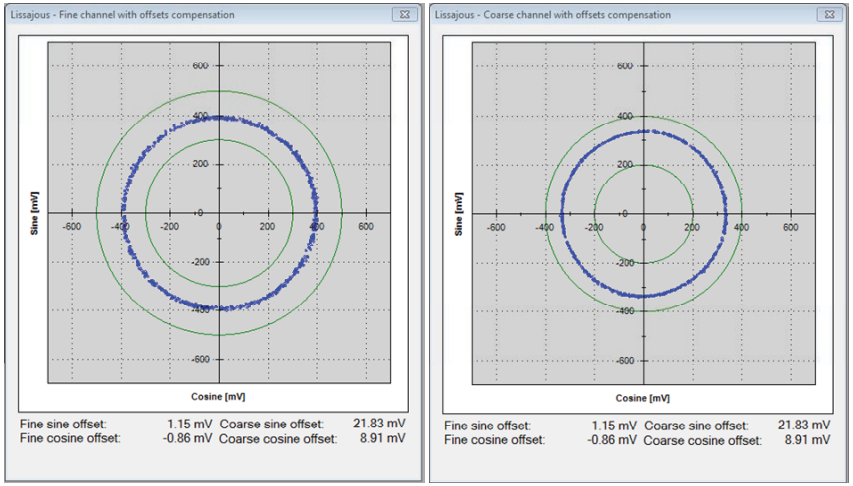


(**b**) Start the data acquisition while rotating the shaft.

The progress bar **(c)** indicates the collection progress.
Rotate the axis consistently during data collection—covering the working sector of the application end to end—by default the procedure collects 500 points over 75 seconds. Rotation speed is not a parameter during data collection. Data collection indication shows for the fine/coarse channels, a clear “thin” circle appears in the center (**d**) (**e**) with some offset.



Offset compensated Fine / Corse Channel

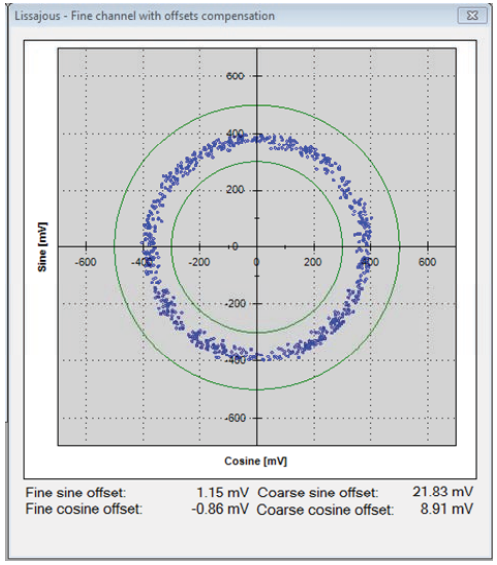

Lissajous - Fine channel with offsets compensation
Sine [mV]
Cosine [mV]
Fine sine offset: 1.15 mV Coarse sine offset: 21.83 mV
Fine cosine offset: -0.86 mV Coarse cosine offset: 8.91 mV
Lissajous - Coarse channel with offsets compensation
Sine [mV]
Cosine [mV]
Fine sine offset: 1.15 mV Coarse sine offset: 21.83 mV
Fine cosine offset: -0.86 mV Coarse cosine offset: 8.91 mV

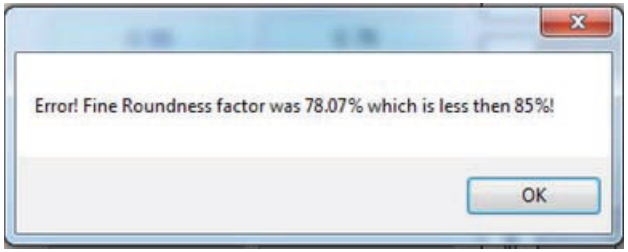
Netzer
Precision Motion Sensors Ltd.

Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

In case the reading data (blue dots) are not evenly distributed on a thin circle, you may experience “noise” in your installation (check shaft/stator grounding).





Contents

Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

8.2 CAA CALIBRATION

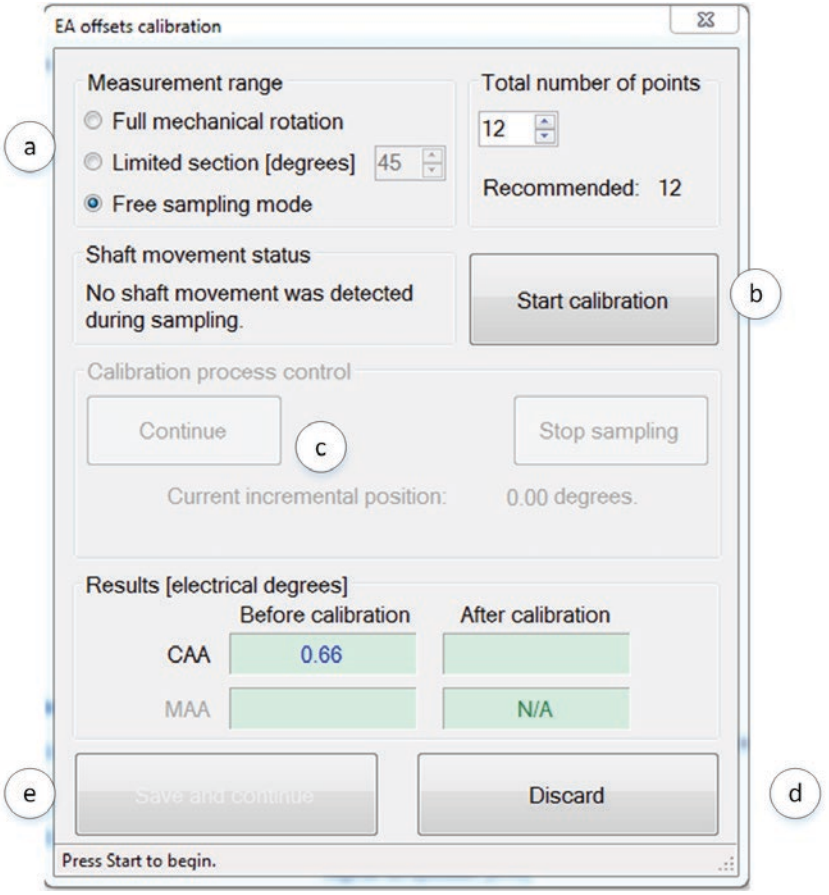
The following calibration aligns the coarse/fine channel by collecting data from each point of both channels.
Select [Continue to CAA Calibration]

In the CAA angle calibration window, select the relevant option button from the measurement range options (**a**):

- *Full mechanical rotation* – shaft movement is over 10deg- recommended.
- *Limited section* – define operation of the shaft in a limited angle defined by degrees in case of <10deg
- *Free sampling modes*- define the number of calibration points in the total number of points in the text box. The system displays the recommended number of points by default. Collect a minimum of nine points over the working sector.

- Click the [Start Calibration] button (**b**)
- The status (**c**) indicates the next required operation; the shaft movement status; the current position, and the next target position to which the encoder should be rotated.
- Rotate the shaft/encoder to the next position and click the [Continue] button (**c**)- the shaft should be in STAND STILL during the data collection. Follow the indication/interactions during the cyclic process for positioning the shaft--> stand still --> reading calculation.
- Repeat the above step for all defined points. Finish (**d**)
- Click the [Save and Continue] button **(e**).

The last step saves the offsets CAA parameters, completing the calibration process.



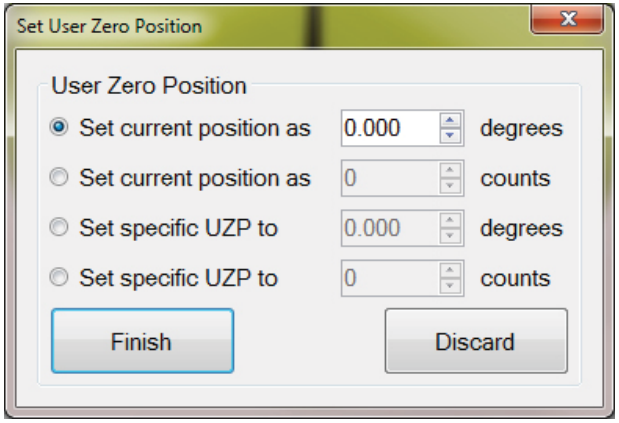
Contents

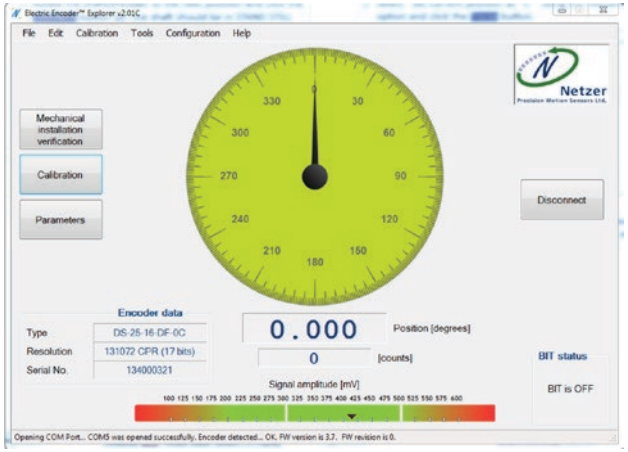
Preface
Safety
Product Overview
Unpacking
Electrical Connection
Software Installation
Mounting Verification
Calibration
Mechanical ICD
Mounting options

8.3 SETTING THE ENCODER ZERO POINT

The zero position can be defined anywhere in the working sector.

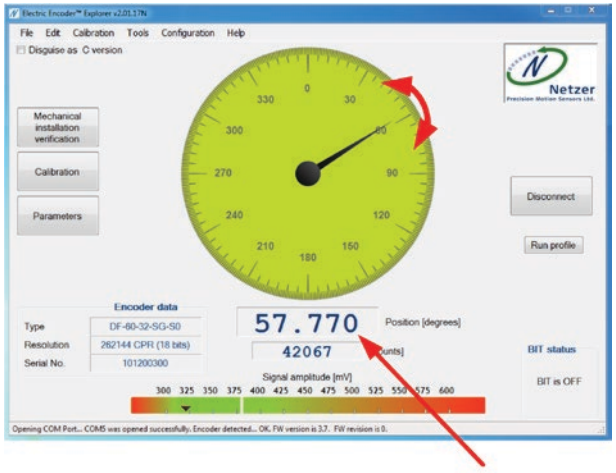
- Rotate the shaft to the desired zero mechanical position.
- Select “Set Current Position” as zero by using the relevant option, and click [Finish].

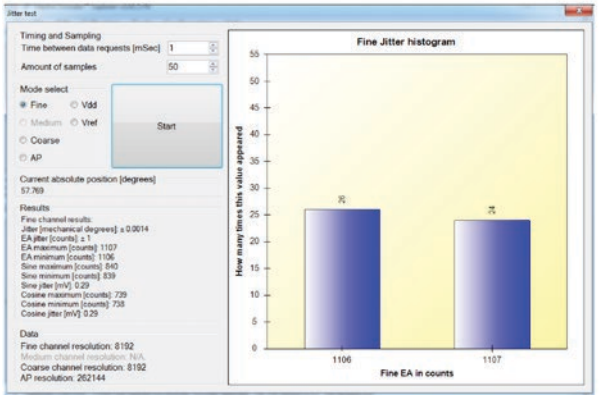




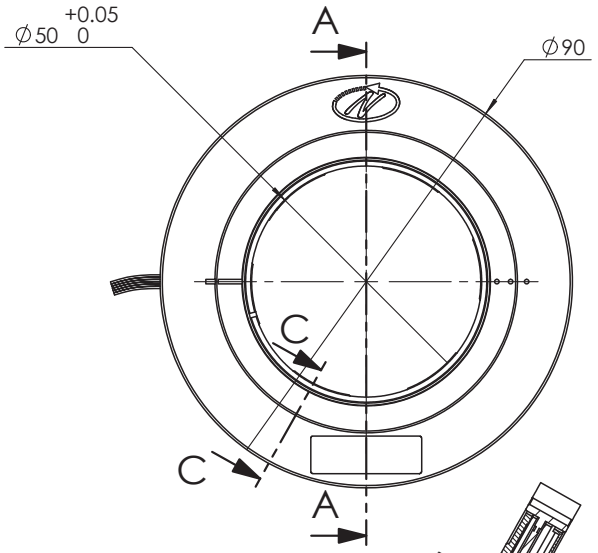
8.4 JITTER TEST

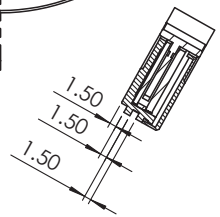
Perform a jitter test to evaluate the quality of the installation; the jitter test presents the reading statistics of absolute position readings (counts) over time. Common jitter should be up +/- three counts; higher jitter may indicate system noise.



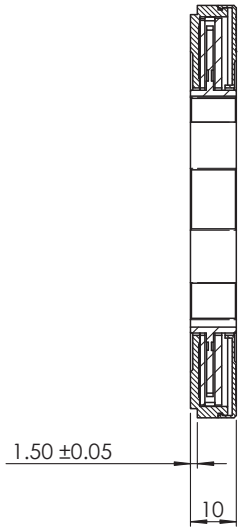


Netzer
Precision Motion Sensors Ltd.

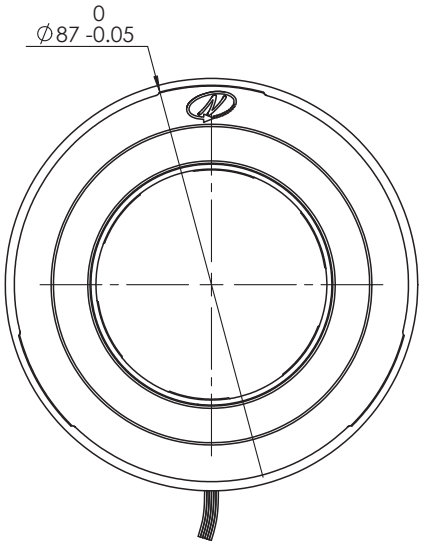


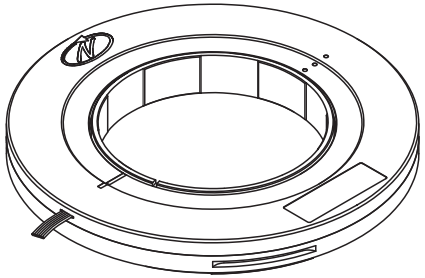


SECTION C-C
3 PLACES



SECTION A-A





Notes:
1) For any incompatibility with the model or missing dimension, please refer to Netzer for clarification.
2) Packing must prevent physical damage during process storage and shipment

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	NAME	SIGNATURE	DATE
DRAWN	V.D		xx.xx.xx
CHK'D			xx.xx.xx
APP'D			xx.xx.xx

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN mm
SURFACE FINISH: N6
LINEAR TOLERANCES:±0.1 mm
ANGULAR TOLERANCES:±0.5 deg
ALL CHAMFER: 0.1 mm X 45°

Netzer Precision Motion Sensors Ltd

TITLE: DS-90 ICD

MATERIAL: | Coating: | SCALE: 1:1

DWG NO. : | Revision : 00 | A3

CAT NO. : -.-

SHEET 1 OF 1

Contents

Preface

Safety

Product Overview

Unpacking

Electrical Connection

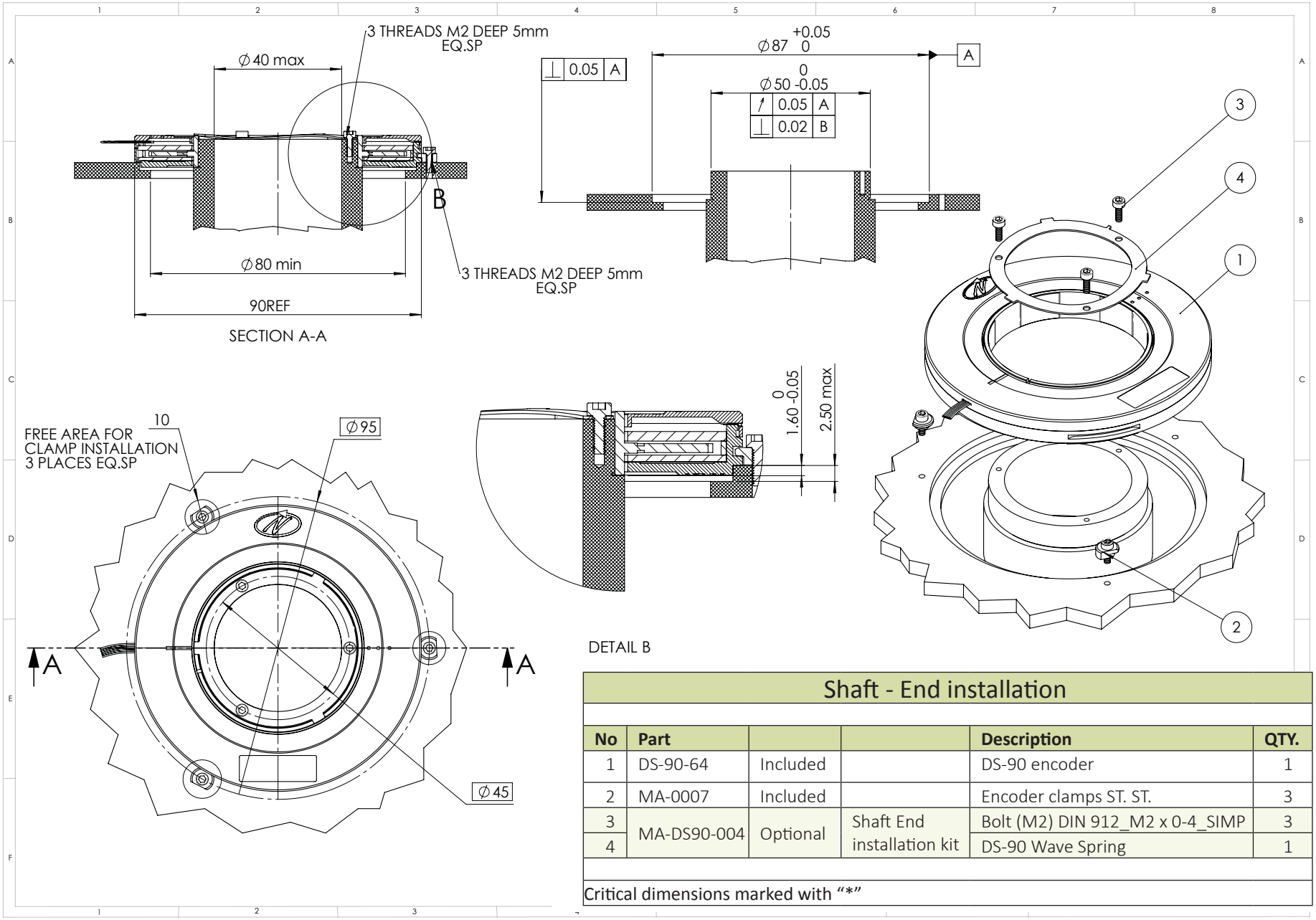
Software Installation

Mounting Verification

Calibration

Mechanical ICD

Mounting options



Shaft - End installation

No	Part			Description	QTY.
1	DS-90-64	Included		DS-90 encoder	1
2	MA-0007	Included		Encoder clamps ST. ST.	3
3	MA-DS90-004	Optional	Shaft End installation kit	Bolt (M2) DIN 912_M2 x 0-4_SIMP	3
4				DS-90 Wave Spring	1

Critical dimensions marked with "*"

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Contents

Preface

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Product Overview

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Software Installation

Mounting Verification

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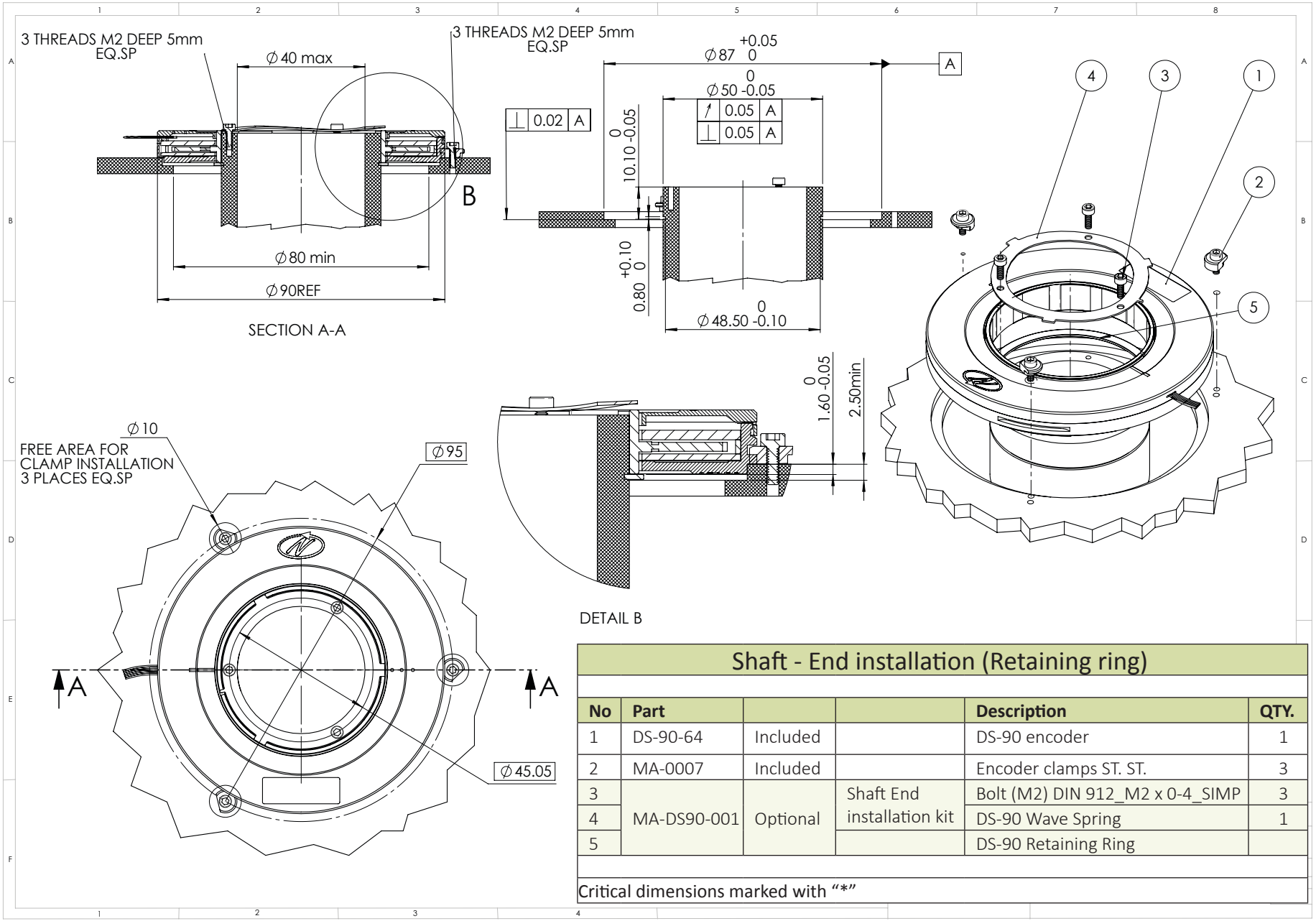
Mechanical ICD

Mounting options



Shaft - End installation (Retaining ring)

No	Part			Description	QTY.
1	DS-90-64	Included		DS-90 encoder	1
2	MA-0007	Included		Encoder clamps ST. ST.	3
3	MA-DS90-001	Optional	Shaft End installation kit	Bolt (M2) DIN 912_M2 x 0-4_SIMP	3
4				DS-90 Wave Spring	1
5				DS-90 Retaining Ring	

Critical dimensions marked with "*"

Netzer Precision Motion Sensors Ltd.